



# Optional Salinity Titration Protocol



## **Purpose**

To measure the salinity of the water sample using the more accurate salinity titration method

## **Overview**

The major dissolved constituents (salts) in sea water are found in relatively constant proportions. By measuring the concentration of any one of them in sea water samples, in this case chloride (chlorinity), the water sample's salinity can then be inferred.

## **Level**

Intermediate, Advanced

## **Time**

10-15 minutes

## **Frequency**

Weekly

Calibration every six months

## **Key Concepts**

Method of measuring salinity using the concentration of one chemical constituent of sea water

Constancy of sea water composition

Standardization

Accuracy

Salinity in water

High and low tides

Precision

## **Skills**

Using the salinity titration test procedure

Designing measurements strategies

Recording data

Interpreting results

## **Materials and Tools**

Salinity Titration Test Kit (See Toolkit)

Data Work Sheets

Latex gloves

1-liter plastic bottle

Table salt

Distilled water

Masking tape

500 mL clear plastic graduated cylinder

Balance

## **Preparation**

Complete the *Calibration* activities below.

## **Prerequisites**

A brief discussion of the relation of salinity to chlorinity and how titration is used to measure them

Practice by doing calibration.

Note: This measurement is for salt and brackish waters only. For fresh waters measure conductivity instead.



Note: For background information and special considerations for brackish and salty water Hydrology Study Sites, please refer to those sections of the *Salinity Protocol*.

## **Calibration and Quality Control**

Calibration should be performed at least every six months to verify your technique and the integrity of your chemicals. Fresh standards should be prepared annually.

## **Salinity Standards**

Salinity standards do not come with the Salinity Titration Kit, and one needs to be prepared as follows:



1. Add water to table salt to make a sea water titration standard of 38.6 ppt salinity. Use this standard to test the accuracy of the Salinity Titration Test Kit.
  - 1.1. Measure out 17.5 g NaCl (table salt) using an analytical balance. Pour this into a 500 mL graduated cylinder.
  - 1.2. Fill the cylinder to the line with distilled water.
  - 1.3. Carefully swirl the solution to mix the standard.
  - 1.4. Pour the solution into a 1-liter plastic bottle and label with masking tape (include the date).
2. Follow directions in the Protocol section to measure the standards. Where it says “sample water” use the standard that you made.
3. Record the value of the standards after testing on the Hydrology Investigation Data Work Sheet.
4. If salinity standards are off by more than 0.4 ppt, prepare new standards and repeat the measurement.

Note: The sea water titration standard concentration is corrected for sea water composition. For example, to calculate the sea water salinity from 17.5 g NaCl in 500 mL (35 ppt NaCl), take into account the molecular composition of NaCl (the ratio of the molecular weight of Cl to NaCl is 0.61):  $35 \text{ ppt} \times 0.61 = 21.35 \text{ ppt}$  chlorinity. The salinity of the standard is  $21.35 \times 1.80655 = 38.6 \text{ ppt}$  because in sea water chloride ions comprise 55.354% of the total dissolved salts by weight.

### **Times of High and Low Tide**

Obtain the times of high and low tide for the location nearest your site for which these are available. The times reported should be for the high or low tide immediately preceding and following the time you make your measurements. Record these times and place they occur on your Hydrology Investigation Data Work Sheet and report them with your other data to the GLOBE Student Data Server.

### **How to Measure Salinity**

1. Use a salinity titration test kit which meets the *Globe Instruments Specifications* in the *Toolkit*. The kits are based on the technique of adding a color indicator to the sample and then adding an acid titrant dropwise until a color change is observed.
2. Follow the manufacturer's instructions on the kit. To titrate more saline water than 20 parts per thousand (ppt), refill the titrator with acid, keeping a record of the total amount of acid used.
3. Record the salinity in ppt on the Hydrology Investigation Data Work Sheet.
4. Take the average of the salinity values measured by the student groups. If the recorded values are all within 0.4 ppt of the average, submit the average to the GLOBE Student Data Server. If they are not within 0.4 ppt of the average have the students retitrate the sample, then record and average the new values. If there is still one outlier (a value far different from the rest) discard that value and average the rest of the values. If they are now all within 0.4 ppt of the new average, report this new average to the GLOBE Student Data Server. If there is a wide scatter (more than 0.4 ppt) in results, discuss the procedure and the potential sources of error with the students, but do not report a value to the Data Server. Repeat the protocol to produce a reportable measurement.
5. Put all liquids in waste bottles.